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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.								
10/731,373	12/09/2003	Chellappa Balan	132814-1/YOD GERD:0067	4420								
<div>7590      06/11/2007</div> <div>Patrick S. Yoder FLETCHER YODER P.O. Box 692289 Houston, TX 77269-2289</div> <div>EXAMINER YUAN, DAH WEI D</div> <table border="1"><thead><tr><th>ART UNIT</th><th>PAPER NUMBER</th></tr></thead><tbody><tr><td>1745</td><td></td></tr></tbody></table> <table border="1"><thead><tr><th>MAIL DATE</th><th>DELIVERY MODE</th></tr></thead><tbody><tr><td>06/11/2007</td><td>PAPER</td></tr></tbody></table>					ART UNIT	PAPER NUMBER	1745		MAIL DATE	DELIVERY MODE	06/11/2007	PAPER
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

Application No.

10/731,373

Applicant(s)

BALAN, CHELLAPPA

Examiner

Dah-Wei D. Yuan

Art Unit

1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 20-35 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 03152004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

**SYSTEM AND METHOD FOR CO-PRODUCTION OF HYDROGEN AND  
ELECTRICAL ENERGY**

Examiner: Yuan

S.N. 10/731,373

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June 4, 2007

***Election/Restrictions***

1. Applicant's election without traverse of Group I, claims 1-35, in Paper filed April 23, 2007 is acknowledged. Furthermore, claims 1-19 were elected for examination in a telephone inquiry June 1, 2007. Therefore, claims 20-35 are withdrawn from consideration.

***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. The term "enhanced" in claim 3 is a relative term which render the claims indefinite. The term "enhanced" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1,3,4,6-9,11,12,15 are rejected under 35 U.S.C. 102(b) as being anticipated by Farooque (US 5,084,362).

With respect to claims 1,9, Farooque teaches a fuel cell system for co-production of hydrogen and electricity comprising a molten carbonate fuel cell assembly and an internal reforming apparatus that produces hydrogen fuel from hydrocarbon gas. The fuel cell system further comprises hydrogen separation and recovery device (8), which separates and recovers the unspent hydrogen in the anode exhaust. See Column 1, Lines 43-56.

With respect to claim 3, Farooque teaches the overall efficiency of the system is improved by using the methane fuel. See Column 2, Lines 21-28.

With respect to claim 4, it is well known in the art that molten carbonate fuel cell can be operated at voltages ranging from 0.55 to 0.8 volts as evidenced by Baker et al. (US 3,522,101), Example 2.

With respect to claim 6, Farooque teaches the oxidant is air.

With respect to claim 7, Farooque teaches the use of methane as the fuel. See Column 2, Lines 22-29.

With respect to claim 8, Farooque teaches the heat provided by the hydrogen for the gasifier (5). See Column 2, Lines 42-53.

With respect to claim 11, Farooque teaches the unspent hydrogen in the anode exhaust is recycled back to the anode inlet. See Figure 1.

With respect to claim 12, Farooque teaches the anode exhaust stream comprises CO, CO<sub>2</sub>, steam and unspent fuel. See Column 2, Lines 54-61.

With respect to claim 15, Farooque teaches the fuel cell system comprising a shift converter and a hydrogen separation and recovery device. See Column 2, Lines 54-61.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Farooque (US 5,084,362) as applied to claims 1,3,4,6-9,11,12,15 above.

The disclosure of Farooque differs from Applicant's claims in that Farooque does not specifically disclose the mole fraction of hydrogen at the anode outlet. However, Farooque discloses the hydrogen content in the exhaust stream can be manipulated by converting any CO in the stream to hydrogen. See Column 2, Lines 53-61. Therefore, it would have been obvious to one of ordinary skill in the art to control the mole fraction of hydrogen in the anode exhaust

between 0.1 to 0.5, because Farooque discloses the amounts of hydrogen in the anode exhaust can be modified by converting the carbon monoxide in the exhaust stream.

9. Claims 1-4,6-8,10-12,15,17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ukai et al. (US 2003/0035983 A1) in view of Take (US 2004/0229092 A1).

With respect to claims 1,3,Ukai et al. teach a fuel cell system comprising a reformer (41) and a polymer electrolyte fuel cell comprising a cathode for receiving a compressed air and an anode for receiving the hydrogen stream. See Figures 1-4, embodiment 3. However, Ukai et al. do not teach the fuel cell system further comprising a separation unit in fluid communication with the fuel cell assembly. Take discloses a fuel cell system comprising a hydrogen separator (68) that is used to separate the hydrogen from the anode exhaust gas. See Embodiment 12. Therefore, it would have been obvious to one of ordinary skill in the art to incorporate a hydrogen separator onto the fuel cell system of Ukai et al., because Take teaches the use of a hydrogen separator to separate the hydrogen from the anode exhaust stream.

With respect to claim 2, Ukai et al. teach the utilization rate of hydrogen supplied is 60 to 80%. See paragraph 190.

With respect to claim 4, it is well known in the art that polymer membrane fuel cell can be operated at approximately 0.7 volts as evidenced by Wheat et al. (US 2004/0197624 A1), paragraph 5.

With respect to claim 6, Ukai et al. teach the use of air as oxidant. See Figure 3.

With respect to claim 7, Ukai teaches the use of methane as the fuel. See paragraph 161..

With respect to claims 8,11, Take teaches the waste heat is used for the steam reforming reaction of the hydrocarbon in the reformer (3). See Embodiment 12.

With respect to claim 10, Take teaches the fuel cell can be a solid oxide fuel cell. See abstract.

With respect to claims 12,15, Take teaches the anode exhaust stream comprises carbon monoxide, carbon dioxide, steam and unspent fuel. See paragraphs 52-55.

With respect claim 17, Take teaches the hydrogen separator has a palladium membrane. See Embodiment 12.

10. Claims 13,14,16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farooque (US 5,084,362) as applied to claims 1,3,4,6-9,11,12,15 above, and further in view of Sridhar et al. (US 2004/0202914).

Farooque disclose a fuel cell system as described above in Paragraph 6. However, Farooque does not disclose the system further comprising a carbon dioxide separator. Sridhar et al. disclose a fuel cell system comprising a carbon dioxide separator (405) to separate the carbon dioxide before the anode exhaust is discharged to the ambient. An adsorption /absorption based separator is sued. See Figure 9, paragraph 93. Therefore, it would have been obvious to one of ordinary skill in the art to use add a carbon dioxide separator downstream of the fuel cell system of Farooque, because Sridhar et al. teach the use of the separator to separate the carbon dioxide before the anode exhaust is discharged to the ambient.

11. Claims 13,14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ukai et al. (US 2003/0035983 A1) and Take (US 2004/0229092 A1) as applied to claims 1-4,6-8,10-12,15,17 above, and further in view of Sridhar et al. (US 2004/0202914).

Ukai and Take disclose a fuel cell system as described above in Paragraph 9. However, Ukai and Take do not disclose the system further comprising a carbon dioxide separator. Sridhar et al. disclose a fuel cell system comprising a carbon dioxide separator (405) to separate the carbon dioxide before the anode exhaust is discharged to the ambient. An adsorption /absorption based separator is used. See Figure 9, paragraph 93. Therefore, it would have been obvious to one of ordinary skill in the art to use add a carbon dioxide separator downstream of the fuel cell system of Ukai and Take, because Sridhar et al. teach the use of the separator to separate the carbon dioxide before the anode exhaust is discharged to the ambient.

12. Claims 18,19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Farooque (US 5,084,362) as applied to claims 1,3,4,6-9,11,12,15 above, and further in view of Nakamura et al. (US 7,052,790 B2).

Farooque disclose a fuel cell system as described above in Paragraph 6. However, Farooque does not disclose the system further comprising a water condenser. Nakamura et al. teach a fuel cell system comprising a cooling water, a cooling water pump, a heat exchanger, a fuel-side condenser and an oxidizer-side condenser that cool exhaust fuel gas and the exhaust oxidizer gas discharged from the fuel cell to condense content water vapor. See abstract, figure 1. Therefore, it would have been obvious to one of ordinary skill in the art to use add a



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condenser downstream of the fuel cell system of Farooque, because Nakamura et al. teach the use of the condenser to condense content water vapor in the exhaust.

13. Claims 18,19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ukai et al. (US 2003/0035983 A1) and Take (US 2004/0229092 A1) as applied to claims 1-4,6-8,10-12,15,17 above, and further in view of Nakamura et al. (US 7,052,790 B2).

Ukai and Take disclose a fuel cell system as described above in Paragraph 9. However, Ukai and Take does not disclose the fuel cell system further comprising a water condenser. Nakamura et al. teach a fuel cell system comprising a cooling water, a cooling water pump, a heat exchanger, a fuel-side condenser and an oxidizer-side condenser that cool exhaust fuel gas and the exhaust oxidizer gas discharged from the fuel cell to condense content water vapor. See abstract, figure 1. Therefore, it would have been obvious to one of ordinary skill in the art to use add a condenser downstream of the fuel cell system of Ukai and Take, because Nakamura et al. teach the use of the condenser to condense content water vapor in the exhaust.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (571) 272-1295. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Dah-Wei D. Yuan  
June 5, 2007



**DAH-WEI YUAN**  
**PRIMARY EXAMINER**